FOREST HEALTH PROTECTION
South Sierra Shared Service Area

Report no. SS09-12

May 29th, 2009
File No. 3420

To: Terri Marceron, Forest Supervisor, Lake Tahoe Basin Management Unit (LTBMU)

Subject: Evaluation of Jeffrey pine mortality near Fallen Leaf Lake Campground

At the request of Scott Parsons, Public Service Program Area Leader, Forest Health Protection (FHP) staff visited a group of standing dead and green-infested Jeffrey pines near Fallen Leaf Lake campground on 5/27/09. The objective of this visit was to assess public/vegetation risk created by recent bark beetle-caused tree mortality. This evaluation summarizes field observations and treatment options available to reduce identified risks.

Observations

Jeffrey pine (*Pinus jeffreyi*) mortality (≈ 35 trees) occurred after Jeffrey pine beetle (*Dendroctonus jeffreyi*) (JPB) attacks from 2006 – 2008 between Fallen Leaf Lake and Fallen Leaf Lake Campground (Figure 1; Appendix A - Map). Based on needle retention rates and Forest Health Monitoring aerial surveys (Appendix A), ≈ 10 and 25 trees faded in 2007 and 2008, respectively. Approximately 15 trees had green or fading crowns, red pitch tubes > 10 feet in height from the ground, and late-instar JPB larvae present as of 5/27/09 (Figures 2 & 3). Trees ranged from 10-35" DBH with majority of stems 15-25" DBH. Picnic areas and a high-use trail were adjacent to the mortality and potential targets for hazardous tree failure.

Figure 1. Grouped Jeffrey pine mortality near Fallen Leaf Lake.

Figure 2. Late-instar Jeffrey pine beetle larvae in the inner bark of a green-infested tree.

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Discussion and Management Options

The JPBs near Fallen Leaf Lake campground were in an advanced developmental stage during our visit and will likely pupate and emerge within 1-2 weeks (June 3rd – June 10th, 2009). JPB population monitoring near Luther Pass from 2006-2008 depicts beetle flight by early June (pers. comm., S. Smith, Regional Entomologist, 5/28/09). Emerging JPB often attack spatially adjacent trees until host material is exhausted or tree growth/vigor improves with increases in precipitation or growing space. High stocking levels and recent periods of below average precipitation have increased campground vegetation susceptibility to JPB-attack and tree mortality (Figure 4; Smith 1971).

Figure 3. Jeffrey pines with fading and faded crowns on 5/27/09.

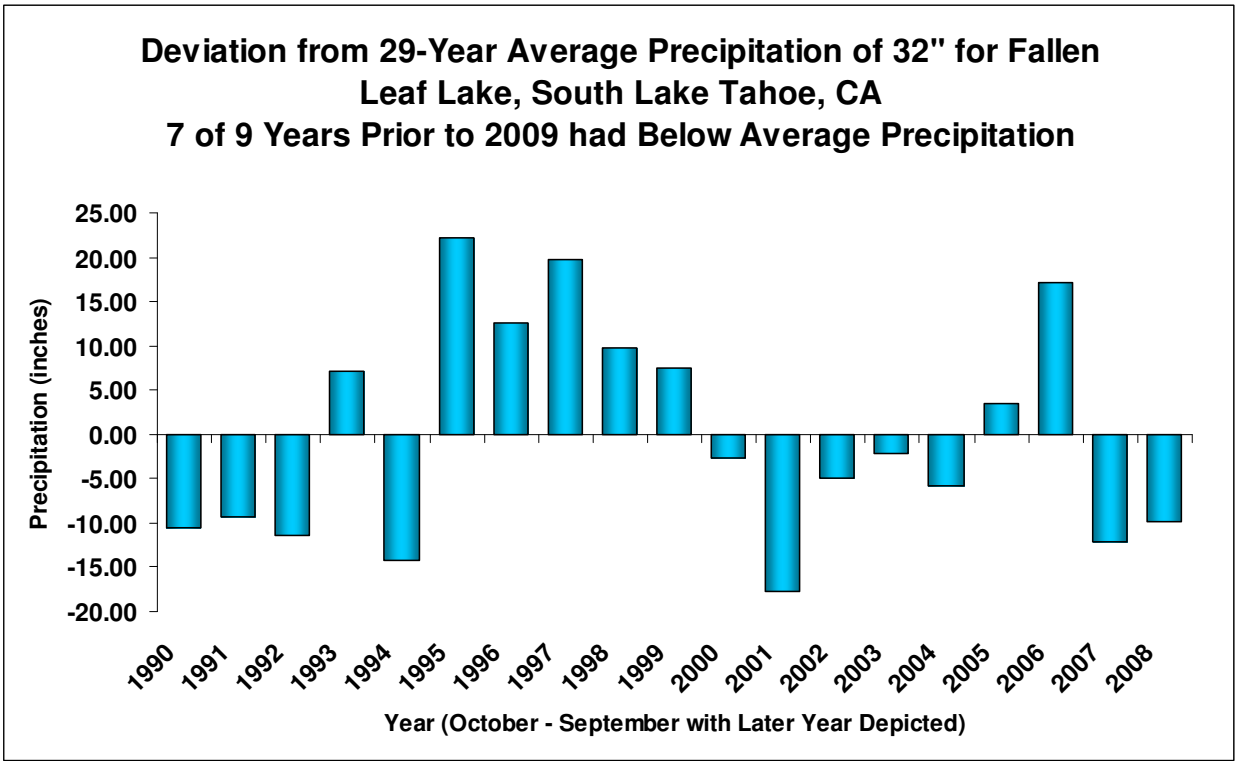

Figure 4. Precipitation data for Fallen Leaf Lake obtained from Natural Resource Conservation Service SNOTEL weather station at: http://www.ca.nrcs.usda.gov/snow/data/historic.html

Jeffrey pine mortality that occurred in 2007 and 2008 did not house developing JPB populations. These trees present some risk of hazardous tree failure to adjacent, high-value targets.

Management options to mitigate identified risks are described subsequently.

Jeffrey Pine Beetle Suppression – Tree Removal

Active suppression of developing JPB brood prior to beetle emergence has previously reduced Jeffrey pine mortality where it has been implemented on a site-specific basis. JPB suppression has been monitored in the LTBMU at Zephyr Cove, Nevada Beach, Camp Richardson, Silver Lake Creek Campground, and Historic Lakes Complex as well as previously in Fallen Leaf Lake campground from 1982-1987. In each case the number of JPB-infested trees was reduced (often by a >50% reduction in attacked trees) following suppression.

The most efficient suppression treatment is to fell and remove infested Jeffrey pines with green or fading crowns from the vicinity of any Jeffrey pine host trees. Infested trees can be identified by removing portions of bark and examining the inner bark for developing JPB brood (Figure 2). As some green infested trees were mass-attacked by the JPB at heights exceeding the lower bole where bark samples can be obtained, trees with >5 red, successful JPB pitch tubes exceeding 10 feet in height or those with boring dust surrounding >50% of the tree bole should be considered for removal. Trees with only red turpentine beetle (*Dendroctonus valens*) (RTB) pitch tubes should be not be considered for removal. RTB pitch tubes are typically in the lower portion of a tree's bole (<10 feet in height from the ground) and are often large (>2 inches in diameter) with copious amounts of dark-red pitch.

FHP personnel are available to assist in identifying trees to be targeted for JPB suppression. The developing JPB brood near Fallen Leaf Lake campground could emerge as early as the first week of June, 2009 and treatments need to occur before beetle flight to be successful.

Vegetation Management for Fallen Leaf Lake Campground

Suppression of the JPB near the campground can reduce the risk of campground pines to attack from adjacent beetle populations; however, it will not reduce the risk of attack from JPBs emerging from other locations. The best way to protect high-value trees in the campground is to promote healthy, vigorous trees by maintaining appropriate stocking levels and minimizing disease incidence. Currently, portions of the campground have overstocked conditions (range 120-380 feet^2 basal area/acre) creating competition-related stress. Multiple campground pines are also stressed from dwarf mistletoe infection, mechanical damage, and recent periods of below average precipitation (Figure 4). These stressors can interact to increase vegetation susceptibility to bark beetle-attack and tree mortality. This is currently exemplified by recent (2009) fir engraver (*Scolytus ventralis*)-associated mortality in ≈ 1 white fir/acre throughout the campground.

A vegetation management plan identifying long-term vegetation objectives and treatments required to meet these objectives is strongly recommended.

Slash Management

Slash created from felling or removing any green-infested trees may be at risk for *Ips* spp. colonization. *Ips* populations can increase in slash >3" in diameter with multiple generations per year and emerge to attack adjacent pines. Populations increase most dramatically in slash created during spring logging operations. Mortality and topkill can occur when attacked trees are physiologically stressed from competition and/or drought conditions. Mortality typically occurs

in smaller (≤ 10" at DBH), pole-sized trees but has been documented in trees up to 26" at DBH during outbreaks (Shultz and Bedard 1987).

To mitigate *Ips* colonization, green slash exceeding 3" in diameter should be lopped (to no greater than 2-3 foot lengths) and scattered in areas where direct exposure to sunlight will promote material drying. Piling of slash and logs should be avoided. All fresh slash and logs should be located several yards away from living trees (Shultz and Bedard 1987). *Ips* spp. typically do not attack material with bark thickness >1"; thus, material exceeding 10" in diameter is not likely for colonization. However, JPBs may infest logs >10" in diameter. This material should be monitored for attack and surrounding Jeffrey pines may benefit from JPB suppression (described previously) prior to beetle flight in Spring 2010.

Hazard Tree Mitigation

Dead trees are at risk for tree failure and damage to high-value targets. Multiple variables (tree species, diameter, heartwood or other decay, root disease infection, wind speeds, soil types, etc.) interact to affect post-mortality snag falling rates (Keen 1929). The majority of trees killed by bark beetles typically do not fall until multiple years after successful attack. However, while the probability for trees falling within a few years of mortality is low, it is not uncommon. Keen (1929) found that 5-9% of beetle-killed ponderosa pine snags fell within three years of mortality in southern Oregon and northeastern California. Morison & Raphael (1993) observed up to 24% fall rates (trees not surveyed for mortality agent) for pine and fir 10 years post-mortality in the Sagehen Creek drainage on the Tahoe National Forest ≈ 39 miles north and slightly west of Fallen Leaf Lake.

To mitigate the potential for hazardous tree failure, snags near Fallen Leaf Lake campground should be felled or targets (picnic benches and high-use horse trail) closed or relocated. The likelihood of tree failure increases each year post-mortality (Keen 1929); thus, hazard tree mitigation should occur as soon as possible.

Preventative Root Disease Treatment

Regional policy (FSM 2303 & FSH 3409.11, Chapter 60) for designated recreation areas requires preventative application of a registered borate fungicide (such as Sporax®) to all freshly cut conifer stumps >2 inches in diameter. Preventative root disease treatment is recommended within four hours of tree felling. This treatment can reduce the spread of the Annosus root rot pathogen (*Heterobasidion annosum*); which, in turn can reduce the potential for tree mortality and hazardous tree failure.

FHP may be able to provide funding assistance for removal of trees infested by JPBs. Suppression treatments generally need to occur prior to beetle pupation and flight in late May. Forest Health Monitoring aerial detection survey data can be utilized to identify mortality adjacent to high-value areas that may benefit from beetle suppression activities. This information is collected annually and maps are available in the Fall after survey flights.

FHP personnel are available to assist in creating a vegetation management plan for high-value recreation areas. Please contact us with any additional questions or requests.

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Appendix A – Map